R·I·T

Title: Woollam Vase

Semiconductor & Microsystems
Fabrication Laboratory **Revision: B** **Rev Date: 11/25/2009**

Approved by:

_____ / / _____ / /
Process Engineer Equipment Engineer

1 SCOPE

The purpose of this document is to detail the use of the Woollam VASE. All users are expected to have read and understood this document. It is not a substitute for in-person training on the system and is not sufficient to qualify a user on the system. Failure to follow guidelines in this document may result in loss of privileges.

2 REFERENCE DOCUMENTS

- Guide to Using Wvase32 Software for Spectroscopic Ellipsometry Data Acquisition and Analysis

3 DEFINITIONS

n/a

4 TOOLS AND MATERIALS

4.1 **General Description-**The Woollam VASE is a variable angle spectroscopic ellipsometer. This purpose of this manual is to show the operation of the Vase, including data acquisition and basic analysis. For more advanced operation please consult the Guide to Using Wvase32.

5 SAFETY PRECAUTIONS

5.1 Hazards to the Operator

5.1.1 Tool has moving parts which may create a pinch hazard. Please use caution during operation.

5.2 Hazards to the Tool

5.2.1 Tool is a very delicate optical system. Do not block motion during operation and do not make any unapproved adjustments to the hardware.

5.2.2 Pins on the alignment detector are fragile. Use caution when inserting and removing the detector. Report any broken pins to staff.

6 INSTRUCTIONS

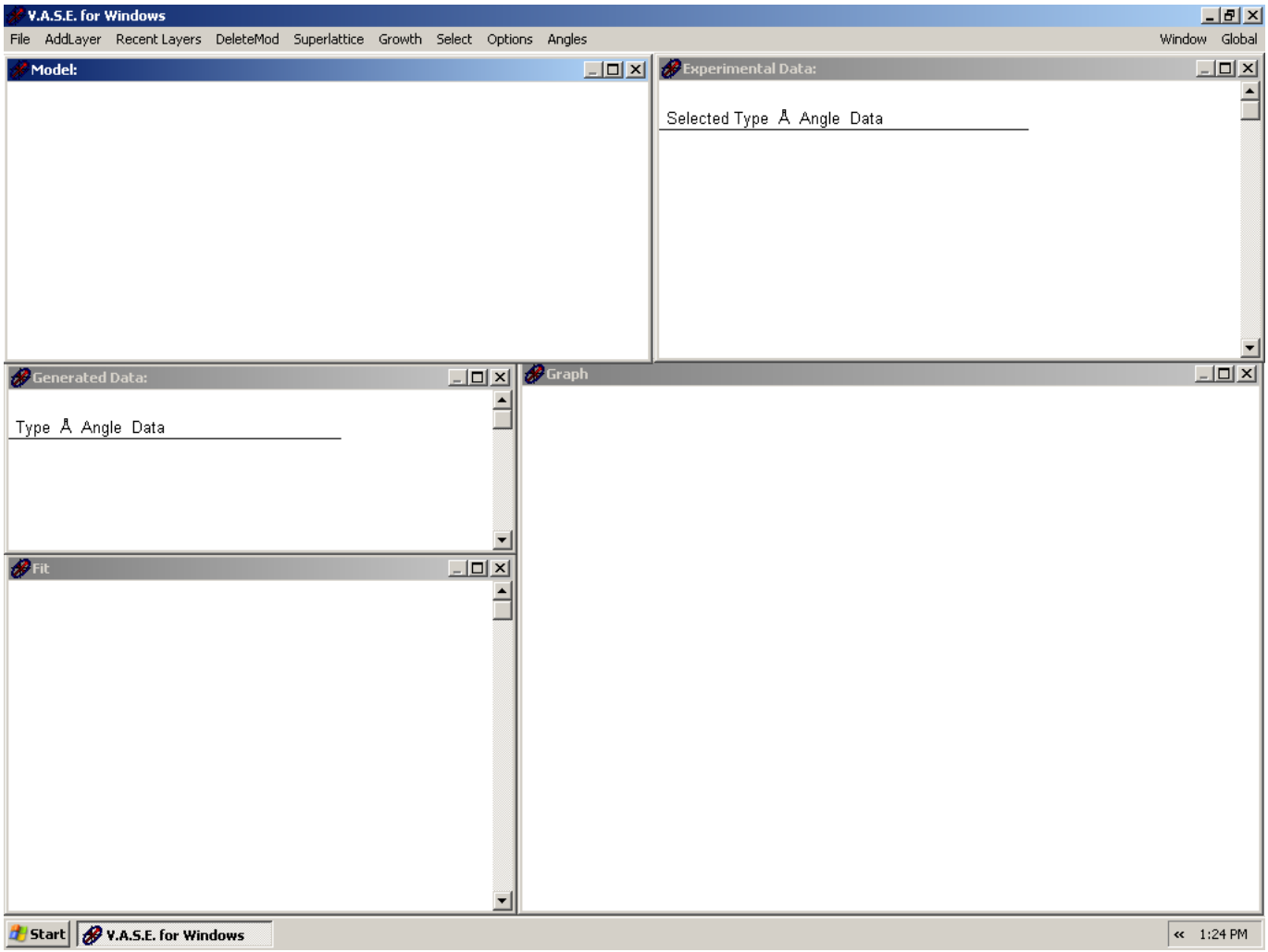
6.1 Initial State Check

6.1.1 On the **HS-190 Light Source** make sure that the **Monochromator Power** is on.

6.1.2 On the **HS-190 Light Source** press **Power** and then **Ignition**. Wait about 30 minutes for the light to stabilize.

6.2 Operating the system

6.2.1 On the desktop open **Wvase32**. This will bring up a screen with several windows including **Model**, **Experimental Data**, **Graph**, **Fit** and **Generated Data**.



6.2.2 At the top right of the screen open the **Hardware** window by selecting **Window** and then **Hardware.** Window will display Hardware NOT Initialized.

6.2.3 In the **Hardware** window right click and select **Initialize**. This will initialize the hardware and prepare the system to acquire data. (about 1 minute)

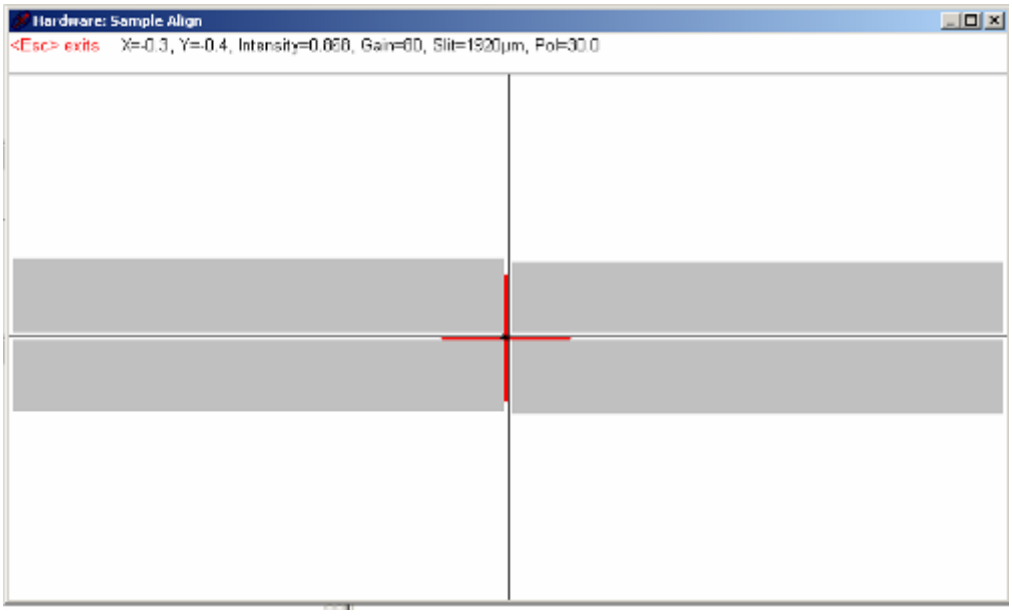
6.2.4 At the prompt enter in a user name. This is where your files will be stored. System will indicate hardware initialized but not calibrated.

6.2.5 Turn on the vacuum and place the reference wafer on the chuck.

6.2.6 Make sure that the iris is fully open.

6.2.7 In the **Hardware** window right click and select **Acquire Data** and **Align Sample**. You will be prompted to insert the alignment detector into the socket. Use care not to damage the pins. The alignment screen will come up and you will see an alignment crosshair.

6.2.8 Use the sample stage tilt knobs on the back of the stage to align the crosshair in the x and y directions to ±0.5 units. The top knob is the Y-adjustment and the bottom knob is the X-adjustment. There will be some noise. You should only have to move them a small amount. When finished, press **Escape** on the keyboard.

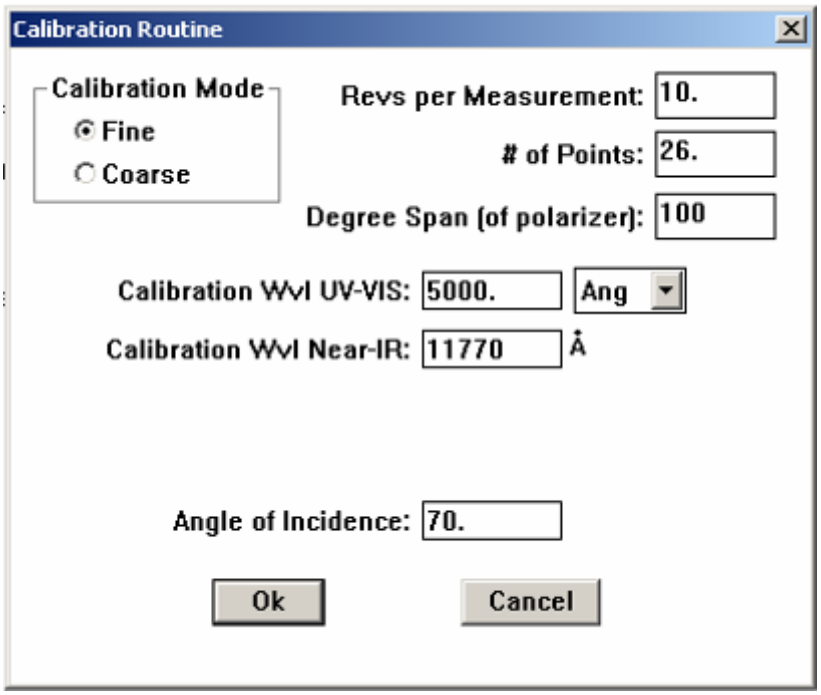


6.2.9 The system will now prompt you to align in the Z-direction. A screen will come up with a real time intensity signal. Use the Z-axis adjustment to maximize this signal. When finished, press Escape on the keyboard.

6.2.10 Remove the alignment detector.

6.2.11 In the **Hardware** window right click and select **Acquire Data** and then **Calibrate System**.

6.2.12 Make sure the **Calibration Mode** is set to **Fine** and hit **OK** to start the calibration. The calibration will run and if there are any problems an error message will be displayed. This should take about 3 minutes. When complete this will display Hardware Initialized and Calibrated.



6.2.13 When the calibration is complete, remove the reference wafer.

6.2.14 Turn on the vacuum and place the sample that you wish to measure on the chuck.

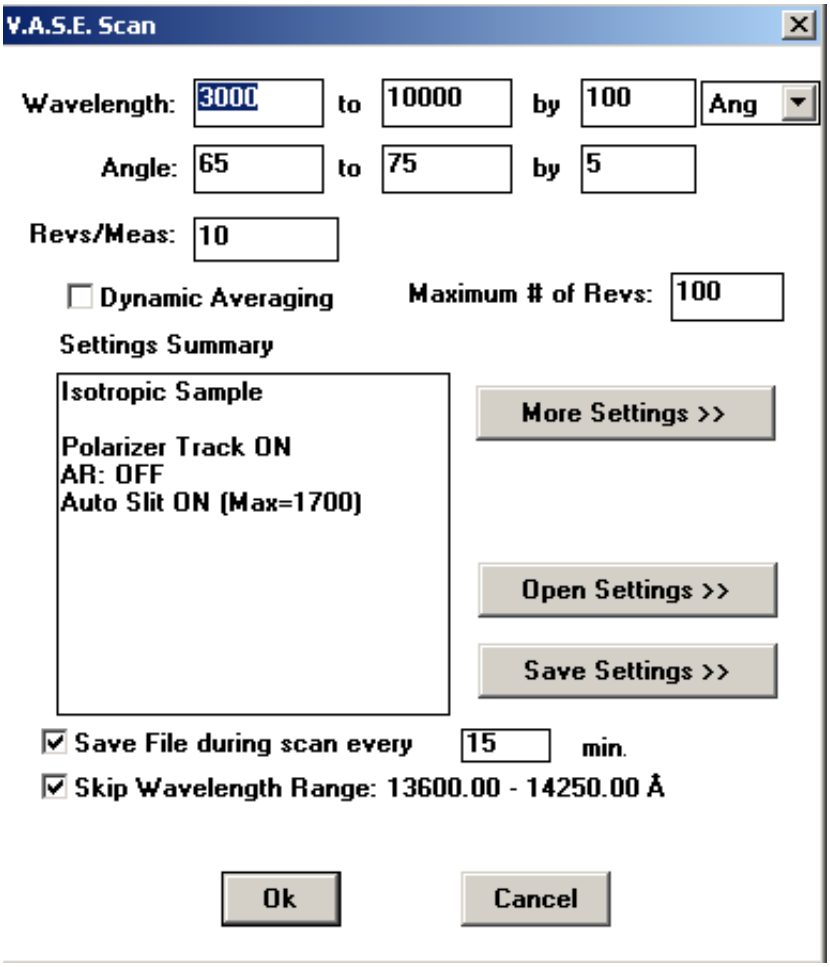
6.2.15 In the **Hardware** window right click and select **Align**. You will be prompted to insert the alignment detector into the socket. The alignment screen will come up and you will see an alignment crosshair.

6.2.16 Use the thumb screws on the back of the stage to align the crosshair in the x and y directions to ±0.5 units. There will be some noise in the signal. You should only have to move them a small amount. When finished, press **Escape** on the keyboard.

6.2.17 The system will now prompt you to align in the Z-direction. A screen will come up with a real time intensity signal. Use the Z-axis adjustment to maximize this signal. When finished, press **Escape** on the keyboard.

6.2.18 Remove the alignment detector.

6.2.19 The system is now ready to acquire data. In the **Hardware** window right click and select **Acquire Data** and then **Spectroscopic Scan**. Start with the default settings and select **OK**. The system will perform a scan. It will take about 15 minutes and could take significantly more time if different settings are used. Thicker films will require longer scans to capture all of the oscillations in the data.



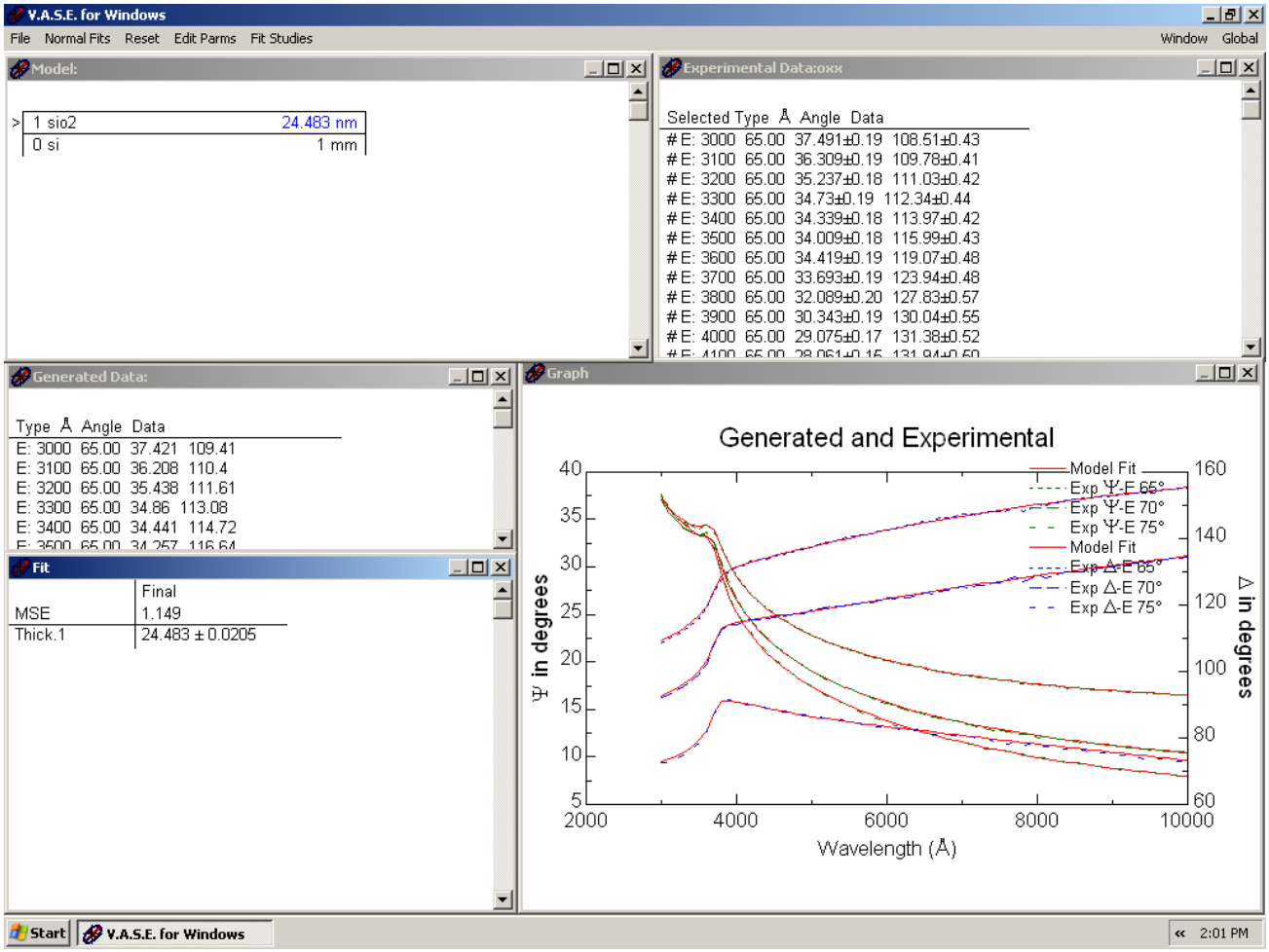
6.2.20 Close the **Hardware** window. The data will be displayed in the **Experimental Data** window and the graph of this data will be displayed in the **Graph** window.

6.3 Analyzing the Data

6.3.1 In the **Model Window** right click and select **Add Layer**. Scroll down and select **Si.mat** as the starting substrate if you are using a silicon wafer. Hit **OK** and then **OK** again to accept defaults.

6.3.2 In the **Model Window** right click on the Si layer and select **Add Above Si**. Scroll down and select the layer to be measured. For example if you are measuring SiO2, select **sio2.mat** and then OK. Enter the expected thickness in nm and check the fit box.

6.3.3 In the **Fit Window** right click and select **Normal Fit**. An MSE will be displayed. A better fit will result in a lower MSE. If the MSE is not low enough select **Normal Fit** again until the MSE does not get any lower. The Normal Fit command uses the iterative Marquardt-Levenberg fitting algorithm which uses all of the data simultaneously.



6.4 Shutdown

6.4.1 Turn off the lamp when finished.

7 APPROPRIATE USES OF THE TOOL

7.1 For dielectric films less than 100A thick, the thickness may be measured with assumed optical constants for the film.

REVISION RECORD

Summary of Changes	Originator	Rev/Date
Original Issue	Sean O'Brien	A-02/28/2007
Added section 5.2.2 to warn about pins	O'Brien	B-11/25/2009